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VARIATIONS IN THE CAROTID ARTERIES OF THE RABBIT

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That the blood vessels of any group of mammals in general are subject to great variations is well known. Such minor variations as have been observed within any group have usually been ignored or at most, resolved to conform to the type. Using the rabbit as a basis of study in mammalian anatomy during the past two years the writer has had an opportunity to make some interesting observations on the variations of the carotid arteries. Of one hundred and fourteen specimens dissected in the laboratory, twenty-three, or about twenty per cent were found to differ from the usual condition described in the texts. Of these, eleven individuals possessed marked differences, as shown in the illustrations in figure 9, which are numbered 1 to 12.

In the majority of cases, the common carotid artery (figure 1, C. C.) passes forward from the superior thoracic aperture along the side of the trachea. Its branches include the superior thyroid artery supplying the thyroid gland, and the superior laryngeal artery. The latter arises at the level of the thyroid plate (larynx) and passes to the sternohyoid and sternothyroid muscles. A short distance cephalad the common carotid artery gives off a very small internal carotid artery which passes dorsad, and disappears beneath the auditory bulla. From this point forward the vessel is the external carotid artery, which gives off successively the occipital, the lingual, the external maxillary, the superficial temporal (one of the terminal branches), and the internal maxillary (the other terminal branch) arteries, in the order named.

The occipital artery passes to the posterior portion of the head from the dorsal wall of the external carotid artery at a point just cephalad to the internal carotid.

The lingual artery arises from the ventral wall of the external carotid artery at a point about at the level of the occipital, and passes forward into the tongue.

The external maxillary artery is given off just cephalad of the lingual branch, and passes to the medial surface of the ventral border of the mandible. It gives branches to the submaxillary gland and the muscles of mastication.

The internal maxillary and the superficial temporal arteries form the two terminal branches of the external carotid artery. The former passes in the direction of the orbit and gives off the inferior alveola branch to the mandible; the latter passes to the temporal region and gives off the transverse facial artery to the cheek and face.

To simplify the presentation of differences found, it is convenient to use the following captions:

The Internal Carotid-Occipital differences—A common difference in the relationships just noted is a condition where the internal carotid artery and the occipital branch arise from the common carotid as a single trunk, the innominate (figures 2, 3, 7 and 12 IN.), which subsequently divides. Interesting gradations in respect to the division are found, from the condition (figure 8) where the two arteries arise separately from the common carotid artery, and where there is no innominate formed, to that where a long innominate is formed as shown in figure 7. The order of the division is of interest also since in some cases (figure 2), the occipital branch is morphologically the most posterior, in others (figures 9 and 12). the internal carotid artery occupies such a position. In the first condition there is no crossing of the two, the occipital passes dorsad to the muscles of the head and neck, and the internal carotid artery passes directly mesad under the auditory bulla. In the second condition, there is a crossing, the occipital branch usually passing laterad of the deeper lying internal carotid trunk, although here again there seems to be some variability, since in one case (figure 4) the opposite is the case.

The External Maxillary-Lingual differences—While there has been noted no case where the sequential order in which these two arteries are given off from the external carotid artery, the relative differences in distances from one another in their origin is worthy of study. In two individuals (figures 6 and 7) the interval between the two is very considerable, being very nearly a centimeter. From this extreme gradations occur, the distance between their points of origin on the carotid gradually approximating one another as is shown in figures 3, 2 and 5 respectively. Finally there is formed in some cases, a common trunk, an innominate, before the division takes place, as shown in figures 4, 9 and 12. It is apparent that this approximation may take place in either direction, that is, the lingual may move cephalad to effect the junction with the maxillary, as shown in figure 9, or the maxillary may move caudad as represented in figure 4. In the condition shown in figure 5, both

arteries have been slightly displaced from the usual position of either. In one case (figure 6), it is interesting to note that the external maxillary is given off as a branch of the internal maxillary artery some distance cephalad of the latter's junction with the superficial temporal. In this case it occupies the relative position of the inferior alveola branch, and might easily have been taken for the latter on superficial examination, the inferior alveola branch in this case being somewhat more cephalad than usual. In two cases, however, figures 4 and 5, where the maxillary and lingual branches are closely approximated, the inferior alveola branch is considerably more caudad than is ordinarily the case.

The Internal Maxillary-Superficial Temporal differences—In some instances these two vessels differ conspicuously in size, and where this condition is most marked, one may be considered a branch of the other. In conditions shown in figures 2 and 3, the superficial temporal is a small side branch passing dorsad while the larger internal maxillary artery continues forward. In other cases (figure 9) the opposite is true, the smaller internal maxilliary artery is a branch of the larger superficial temporal trunk, and in this case its point of origin from the temporal is well cephalad.

In two cases represented by figure 7, the relationship of these terminal branches of the external carotid artery are of interest since they together with the external maxillary artery form a three parted fork, the external maxillary artery turns abruptly ventral, the superficial temporal passes dorsad, and the internal maxillary bends mesad. In size there is very little difference between the three vessels, any one of which could be considered a terminal branch of the external carotid artery.

The Superficial Temporal-Occipital differences—In three cases the occipital artery originates as a branch of the superficial temporal. In one individual (figure 9) it passes dorsad from what may be considered the base of the superficial temporal or its innominate. In figure 5 it is but a little more cephalad, while in figure 10 it is shown passing away from the temporal well cephalad to the latter's junction with the other arteries.

Other differences—In one case shown in figure 11, all the arteries pass forward away from the common trunk in such a way as to form a sort of corona radiata. In such a condition the external carotid artery is practically eliminated, since the common carotid artery is broken up immediately into five terminal branches. In the condition shown in figure 12 the common carotid artery can be considered as terminating in three innominate trunks; one giving rise

to the internal carotid and occipital branches, one forming the external maxillary-lingual branches, and the third, the internal maxillary-superficial temporal branches. In the condition shown in figure 10, the external carotid artery is very short, terminating in four branches, one of which is an innominate which forms the superficial temporal and occipital branches.

In two cases, the inferior alveola artery which normally is considered a branch of the internal carotid artery, shows a tendency to branch well down on the external carotid trunk. This condition is indicated in figures 4 and 5. On the other hand, the external maxillary artery which normally is a branch of the external carotid, in two individuals (figures 3 and 6), branches well cephalad from the internal maxillary artery.

Summary—Variations in the relative positions and points of origin of the several vessels along the common carotid artery result in the formation of several innominate arteries. Those of especial interest are the occipital-internal carotid, the external maxillary-lingual, the internal maxillary-superficial temporal, and the superficial temporal-occipital arteries, represented in figures 2, 4, 9 and 10, respectively.

After the common carotid artery gives rise to the internal carotid or to the innominate (internal carotid-occipital), the remaining trunk, the external carotid artery, may terminate in a number of ways; it may end as a single trunk (either the internal maxillary or the superficial temporal); it may be bi-parted (as normally) or by two innominates as in figures 9 and 12; it may be three-parted formed by the two maxillaries and the temporal as in figure 7; it may be four-parted, formed by the two maxillaries, the temporal and the lingual as in figure 8 or by the lingual, the two maxillaries and the innominate as in figure 10; or it may be five-parted, formed by the two maxillaries, the lingual and the temporal and the occipital.

The inferior alveola artery which normally is a branch of the internal maxillary, is in two cases (figures 4 and 5), well down on the external carotid artery.

The external maxillary artery in one case (figure 6) is given off as a branch of the internal maxillary some distance cephalad to the latter's junction with the temporal. In several cases both the lingual and the external maxillary arteries pass out of the external carotid artery at the level of the internal maxillary and superficial temporal arteries as in figures 8, 10 and 11.

The occipital artery varies considerably in its origin. It may be a branch from the internal carotid artery as in figures 2, 3, 7 and 12; it may branch as an independent twig from the external carotid artery as in the normal condition as shown in figures 4, 6, 8 and 11; or it may be a branch from the temporal as in figures 5, 9 and 10.

In one case, figure 3, the lingual and the external maxillary arteries may be regarded as branches from the internal maxillary, since their points of origin are well cephalad to the point at which the temporal branch is given off.

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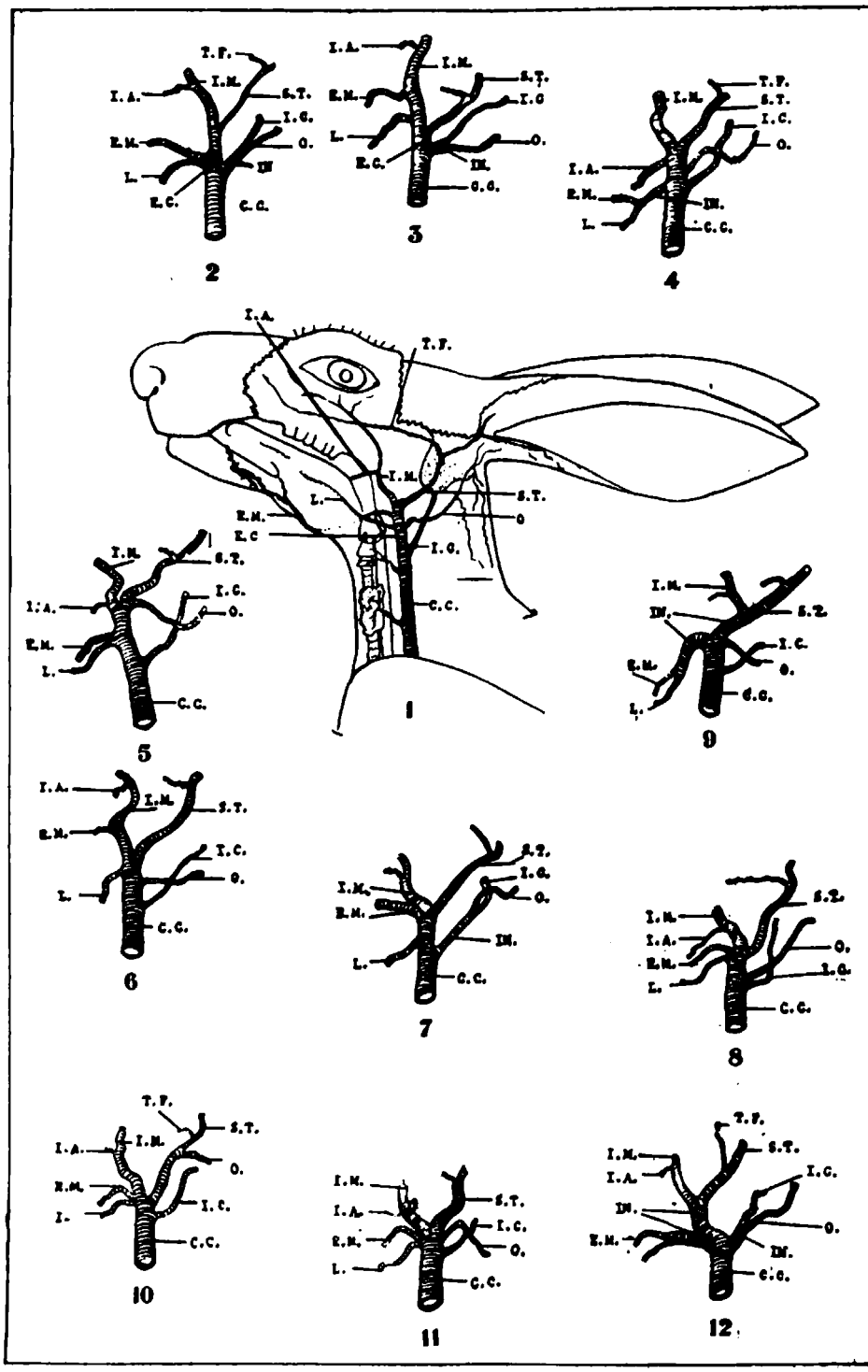

FIGURE 9

EXPLANATION OF FIGURE 9

Fig. 1. Branches of the common carotid artery (left side) showing order and distribution in the majority of cases.

Fig. 2. Variation in which the occipital and internal carotid arteries

leave the common carotid artery together as an innominate artery. The superficial temporal is much smaller than the internal maxillary and can be regarded as a branch of the latter.

Fig. 3. The innominate of the internal carotid and occipital and the superficial temporal are close to each other, while the lingual, external maxillary and inferior alveola may be regarded as branches from the internal maxillary.

Fig. 4. The external maxillary and lingual arteries arise as an innominate from the common carotid. The occipital and the internal carotid arteries are in the reverse sequence from the condition shown in Figs. 2 and 3, and the former passes mesad to the latter. The inferior alveola is a branch from the external carotid.

Fig. 5. The occipital leaves the superficial temporal close to the latter's base; the external maxillary and the lingual arteries arise close together from the external carotid while the inferior alveola is at the base of the internal maxillary.

Fig. 6. The external carotid artery in this case terminates in three branches: the lingual, superficial temporal and internal maxillary, the external maxillary and inferior alveola being branches of the latter.

Fig. 7. The external carotid artery terminates in three branches: the external maxillary, the internal maxillary and superficial temporal. Note the comparatively long innominate which divides to form the occipital and internal carotid arteries.

Fig. 8. The lingual and external maxillary arteries originate close to the junction of the internal maxillary and superficial temporal arteries.

Fig. 10. The occipital artery is a branch of the superficial temporal which leaves the latter well cephalad.

Fig. 9. The external carotid terminates in two innominate arteries, one giving rise to the lingual and external maxillary arteries, the other forming the internal maxillary and superficial temporal arteries. The occipital branch is small and comes off of a point of junction of the two innominates.

Fig. 11. All the branches of the common carotid are close to one another forming a sort of corona radiata at its termination.

Fig. 12. The common carotid artery breaks in this case into three innominate arteries: the external maxillary-lingual, the internal maxillary-superficial temporal and the internal carotid-occipital arteries.

ABBREVIATIONS

C. C.—Common Carotid Artery.
E. C.—External Carotid Artery.
E. M.—External Maxillary Artery.
I. A.—Internal Alveola Artery.
I. C.—Internal Carotid Artery.
I. M.—Internal Maxillary Artery.
I. N.—Innominate Artery.
L.—Lingual Artery.
O.—Occipital Artery.
S. T.—Superficial Temporal Artery.
T. F.—Transverse Facial Artery.